

Notice of Allowability

Application No.

09/998,787

Examiner

Pamela E Perkins

Applicant(s)

BAO ET AL.

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the filing of the amendment on 16 December 2003.
2. ☒ The allowed claim(s) is/are 1-29.
3. ☒ The drawings filed on 31 October 2001 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
 - * Certified copies not received: _____.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
 - (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No. _____.
 - (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
 - (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892) | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____ |
| 3 <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____ | 7 <input type="checkbox"/> Examiner's Amendment/Comment |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9 <input type="checkbox"/> Other |

Michael Trinh
Primary Examiner

1/9/04

DETAILED ACTION

This office action is in response to the filing of the amendment on 16 December 2003. Claims 1-29 are pending.

Allowable Subject Matter

Claims 1-29 are allowed.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance: prior art does not anticipate, teach, or suggest a method of copper metallization in the fabrication of an integrated circuit device where an opening is formed in a dielectric layer; forming a copper layer in the opening; coating an oxide layer on the dielectric layer, copper layer and on the walls of a deposition chamber; heating the structure in the deposition chamber and depositing a capping layer over the oxide layer.

For example, Ngo et al. (6,472,755) disclose a method of copper metallization in the fabrication of an integrated circuit device where an opening is formed in a dielectric layer overlying a substrate; forming a copper layer within the opening; coating the copper layer with an oxide layer and depositing a silicon nitride or silicon carbide capping layer on the oxide layer. Ngo et al. further disclose heating the substrate in a deposition chamber using a NH_3 plasma. Ngo et al. also disclose forming the copper layer using a physical vapor deposition (PVD) process, a chemical vapor deposition (CVD) process, electroplating or electroless plating. However, Ngo et al. do not

disclose, anticipate, teach, or suggest coating an oxide layer on the dielectric layer, copper layer and on the walls of a deposition chamber; heating the structure in the deposition chamber and depositing a capping layer over the oxide layer.

Givens et al. (6,080,655) disclose a method of copper metallization where an opening is formed in a dielectric layer overlying a substrate; forming a copper layer within and over the opening; using a CMP process to polish back the copper layer to only within the opening and then depositing a capping layer on the copper layer. Given et al. further disclose forming the copper layer using a PVD process, a CVD process, electroplating or electroless plating. Givens et al. also disclose the substrate having semiconductor structures such as gate electrodes, source and drain regions, lower level metallization and the opening connecting the a semiconductor structure. However, Givens et al. do not disclose, anticipate, teach or suggest coating an oxide layer on the dielectric layer, copper layer and on the walls of a deposition chamber; heating the structure in the deposition chamber and depositing a capping layer over the oxide layer.

The prior art made of record in this action does not anticipate, teach, or suggest a method of copper metallization in the fabrication of an integrated circuit device where an opening is formed in a dielectric layer; forming a copper layer in the opening; coating an oxide layer on the dielectric layer, copper layer and on the walls of a deposition chamber; heating the structure in the deposition chamber and depositing a capping layer over the oxide layer.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably


accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Pamela E Perkins whose telephone number is (703) 605-4299. The examiner can normally be reached on Monday thru Friday, 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.


Michael Trinh 11/9/04
Primary Examiner

PEP